County Geologic Atlas Program: 2 Parts

MGS Part A: Geology

Status of County Geologic Atlas Part A January 2019

DNR Part B: Hydrogeology

https://www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html
Geologic Atlas of Washington County
Part A

• Plate 1: Data-Base Map
• Plate 2: Bedrock Geology
• Plate 3: Surficial Geology
• Plate 4: Quaternary Stratigraphy
• Plate 5: Sand Distribution Model
• Plate 6: Bedrock Topography and Depth to Bedrock

ALL PRODUCTS AVAILABLE AS PAPER MAPS/REPORTS
AND AS DIGITAL FILES SUITABLE FOR GIS APPLICATIONS
Data-Base Map

- Exposures of the rock
- Core samples
- Water well construction records (CWI) (>14,000 located wells)
- Scientific and engineering borings (QDI)
- Drill cuttings
- Borehole geophysical log
- Giddings probe holes
- Texture analysis
- Soil auger hole
- Passive seismic sounding
- Seismic refraction sounding
• Bedrock geologic maps depict the type, structure, and distribution of all of the different bedrock units beneath the Quaternary sediment.
Bedrock Geology

Cross sections depict how the rock formations are stacked in a vertical sequence, their structure and thickness.
Bedrock Geology

Washington County Structure Mapping of the top of the Jordan Sandstone

- Over 500 feet of relief on the Jordan surface
- Near vertical displacement on the order of 50-300 feet at faults
- Rasters of tops of all bedrock units are part of the atlas products (therefore the elevation and thickness of all units is gridded)
Related MGS research offers information on hydrogeologic properties (some of which is used for DNR Part B of atlas)

BEDROCK HYDROSTRATIGRAPHIC FRAMEWORK

Based on:
30+ years detailed mapping
Thousands of borehole geophysical logs
Hundreds of hydraulic tests at multiple scales
Fracture characterization (outcrop and boreholes)
Groundwater chemistry (esp residence time, e.g. MNDNR Part B atlases)
Dye tracing

Some Key References relevant to SE MN:
Alexander et al 1996
Tipping et al 2006
Anderson et al 2011
Luhman et al 2011
Green et al 2012
Meyer et al 2016
Many other reports/pubs on county & smaller scale map and hydro projects,
including Washington Co
Hydrostratigraphy integrated with regional water chemistry data for conceptual model of contaminant transport
Bedrock Topography

- Elevation of the bedrock surface (350-1050 ft)

Depth to Bedrock

- Range from 0 to 450 feet thick.

Possible preferential transport
Quaternary Unconsolidated sediment

Surficial Geologic map

Surficial Sand and Gravel only (with thickness)

Sand and Gravel

Fine Lake sediment

Diamict (till)
Quaternary Unconsolidated sediment

Cross-sections

Diamict (till)

Sand
Quaternary Unconsolidated sediment Sand Models (here showing depth and thickness of three sand and gravel units)
Quaternary Unconsolidated sediment

Sand Models

Stacked surfaces from land surface to bedrock surface
Major sand bodies on left
Intervening till and other fine grained sed on right
Gray shading is bedrock surface
Quaternary Unconsolidated sediment
Groundwater modeling

- “Containers” geometrically more complex than bedrock
- Matrix more complex
- Fractures poorly understood
- K values scarce and for fine units uncertain
- A number of methods have been applied for modeling

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<th>Method</th>
<th>Grainsize</th>
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Tipping et al., 2010
DNR Part B: Hydrogeology

- Illustrates groundwater hydrogeologic setting, aquifer distribution, pollution sensitivity, groundwater recharge, and subsurface flow of the aquifers within the county.

Example Hydrogeologic cross section